

ENGINE SERVICE MANUAL

VANTAGE VEHICLE INT'L, INC.



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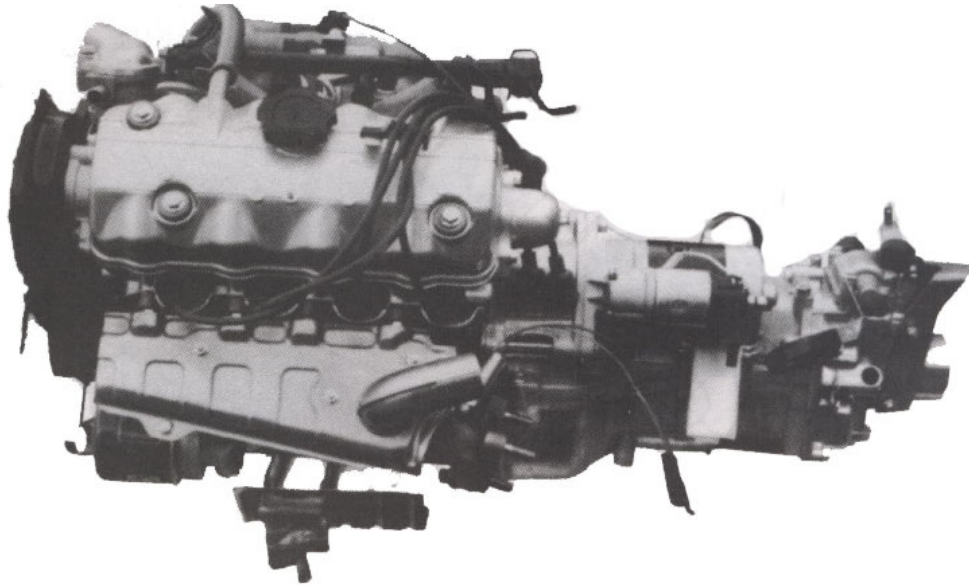


Figure 1 Engine picture (left view)

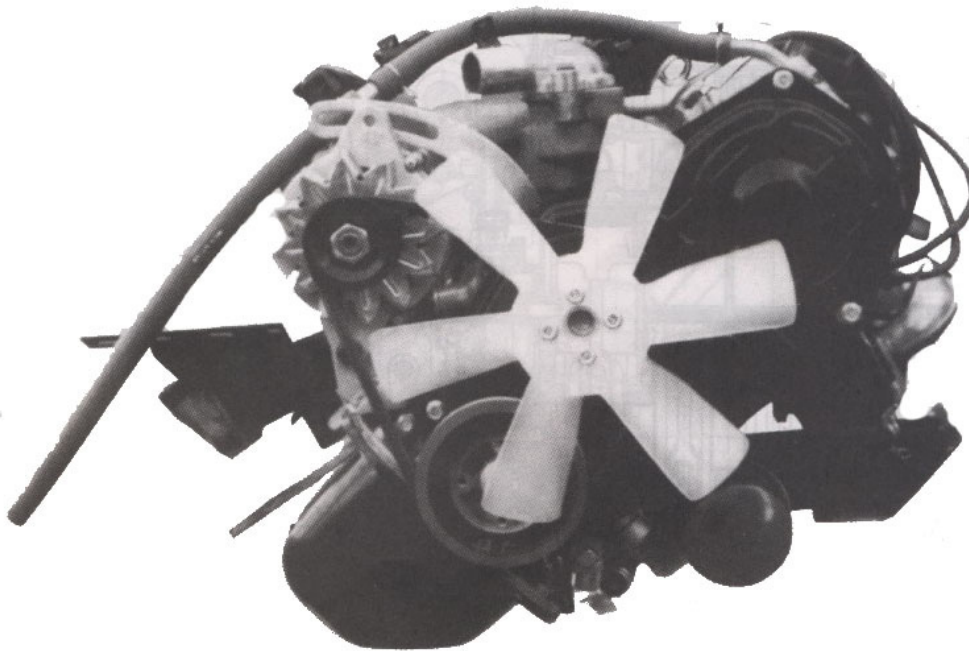


Figure 2 Engine picture (front view)

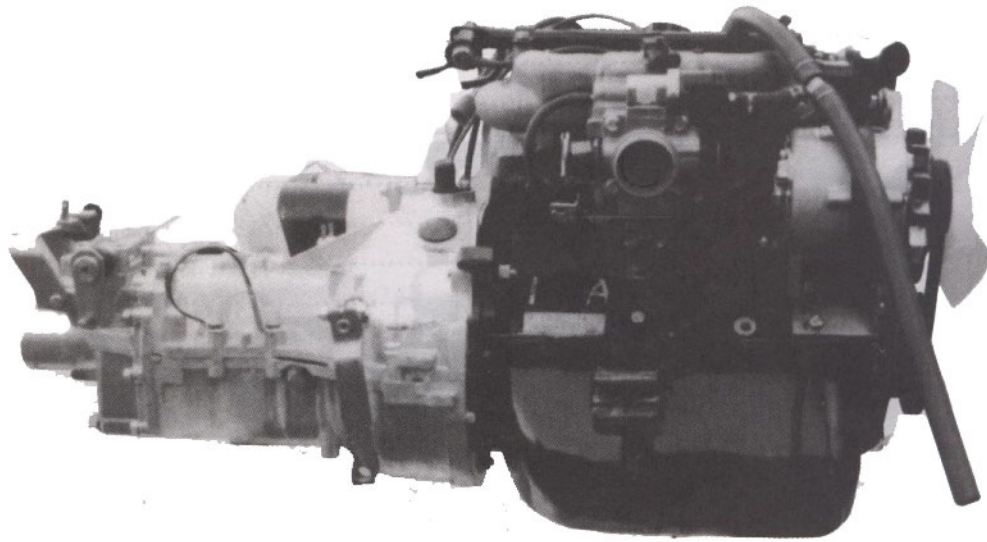


Figure 3 Engine picture (right view)

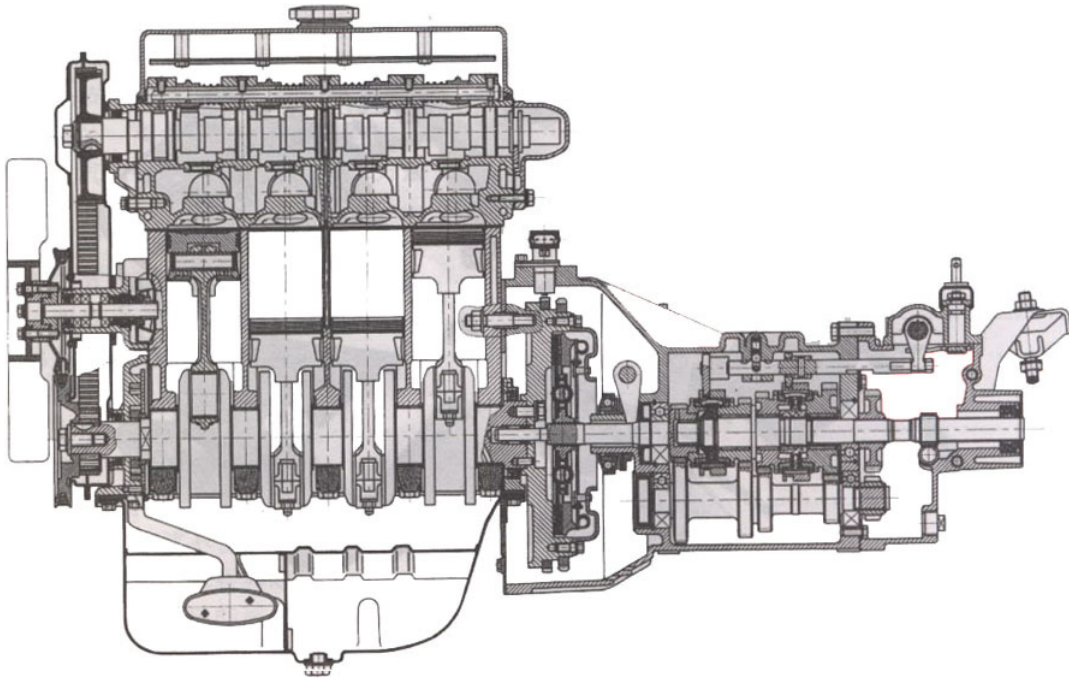


Figure 4 cutaway view of the gasoline engine(lengthways)

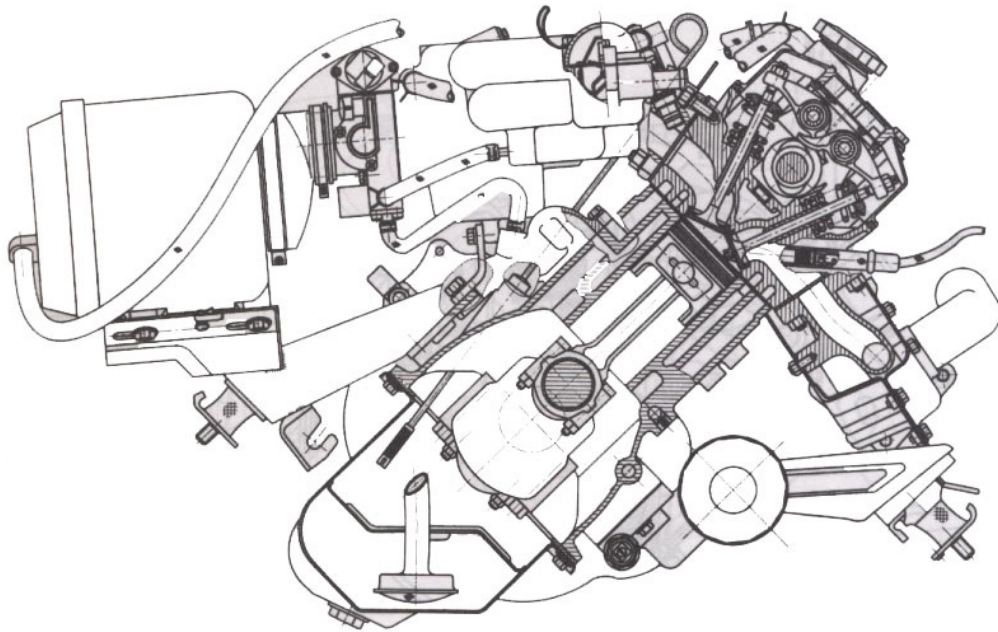


Figure.5 cutaway view of the gasoline engine(transverse)

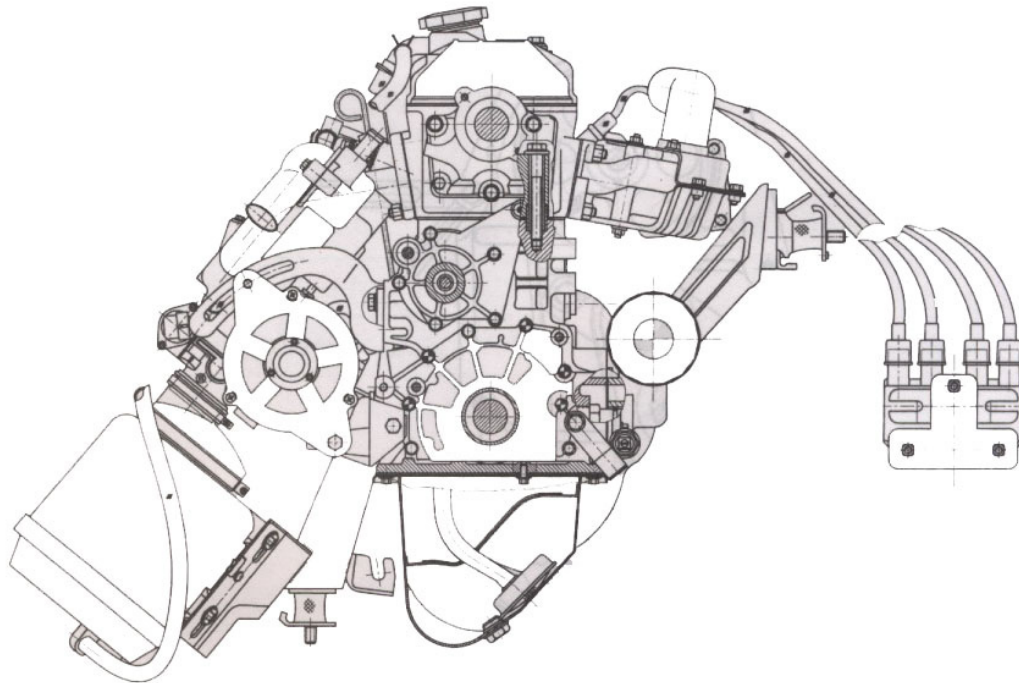


Figure.6. outline of the gasoline engine(without casing of timing belt)

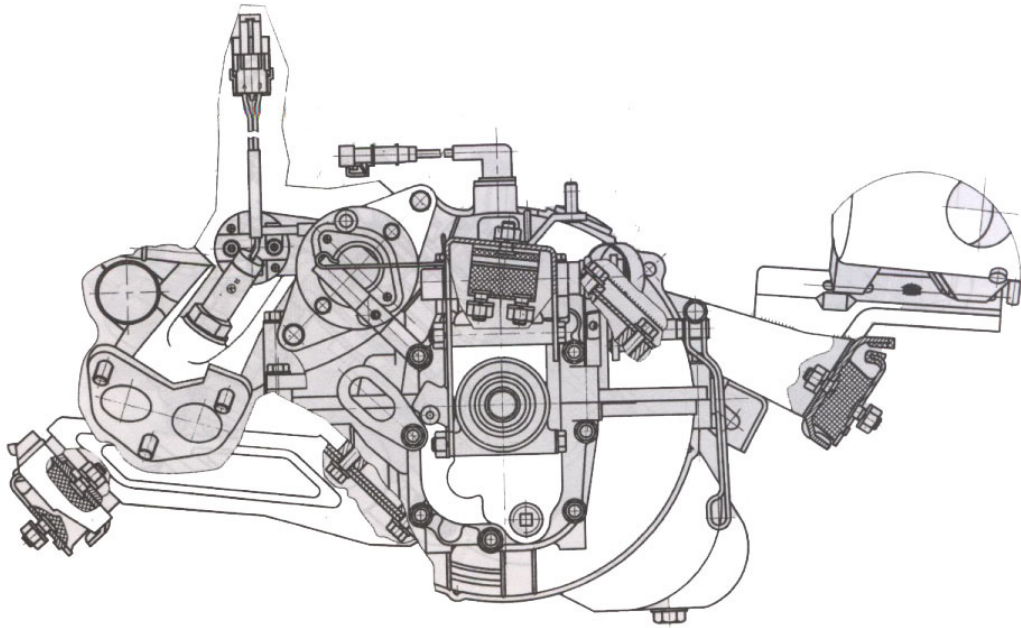


Figure.7 Rear view of the gasoline engine

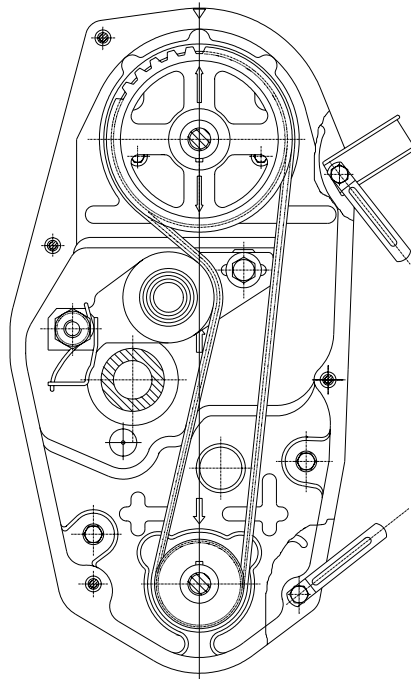


Figure8 Front view of valve mechanism transmission

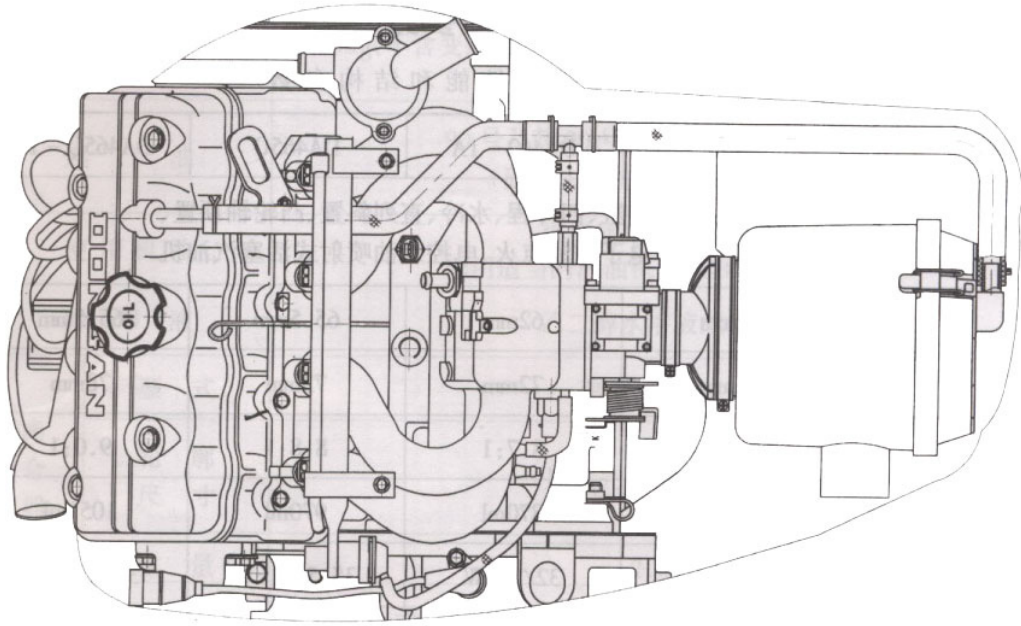


图-9 top view of the intake system of the engine

Chapter 1 Performance and structural parameters of the petrol engine

Section 1 Performance and structural parameters of the petrol engine

Table 1 Technical characteristics and structural parameters of the petrol engine

Type	LJ465QE1		LJ465Q-1AE1	
Model	Electronically controlled MPI gasoline engine with 4 cylinder, 4 stroke, forced water-cooling, in-line cylinder and overhead camshaft			
Bore dia.	65.5mm		65.5mm	
Stroke	72mm		78mm	
Compression Ratio	8. 8 : 1		9. 0: 1	
Displacement	995cc		1051cc	
Rated power	35.5/31kW		38.5/34kW	
Max. torque	74/68N&m (3000~3500r/min)		83/76N&m (3000~3500r/min)	
Min. fuel consumption	275/300g/kW&h		275/300g/kW&h	
Rated speed	5000r/min		5200r/min	
Idle speed	850±50r/min		850±50r/min	
Emission	At idle speed	CO≤0.5% HC≤100PPm DB11/044-1999		
	At high idle speed	CO≤0.3% HC≤100PPm DB11/044-1999		
	In NEDC cycle	CO≤2. 2 g/km HC+NO _x ≤ 0.5g/km ECE96		
Sense of rotation	Counter clockwise (viewed from backside)			
Ignition sequence	1—3—4—2			
Oil pressure	0.294~0.539MPa (3.0~5.5kgf/cm ²) 3000r/min			
Fuel	Lead -free gasoline RON90 (GB19730-1999)or higher			
Oil		Selected according to the temperature of the region where the engine is operated (GB11121-1995)		
Coolant		Glycol water solution or soft water		
Clutch	Model	Single-leaf spring, diaphragm spring		
	Overall dimension	(Clutch housing): 217×63mm		
	Weight	2.8 kg		
Gear box	gear ratio	Gear 1: 3.505		Gear 1: 3.652
		Gear 2: 2.043		Gear 2: 1.948

		Gear 3: 1.383	Gear 3: 1.424
		Gear 4: 1.000	Gear 4: 1.000
		Gear 5: 0.806	Gear 5: 0.795
		Reverse gear: 3.505	Reverse gear: 3.466
	Type	Gear meshing type, all with synchronizer , 1 reverse gear.	
		5 forward gears	5 forward gears
	Overall dimension	(L×W×H) 477.5×270×287.4mm	(L×W×H) 535.5×390.4×276.3mm
	Weight	16kg	28kg
	Lubrication oil	Gear oil to be selected according to the temperature of the region where the engine is operated GL-4 or GL-5 gear oil (GB13895-92) or No.18 hypoid gear oil	

△ The Rated power, Max Torque and Min. fuel consumption index of the petrol engine is “gross power/net power” .

△ △ : The emission standard for petrol engine is a mandatory national regulation that is subject to continuous modification. The MPI series engine made by Liuji Company will be improved continuously to meet the up-to-date national regulation.

Section 2 Full load performance curve of the gasoline engine.

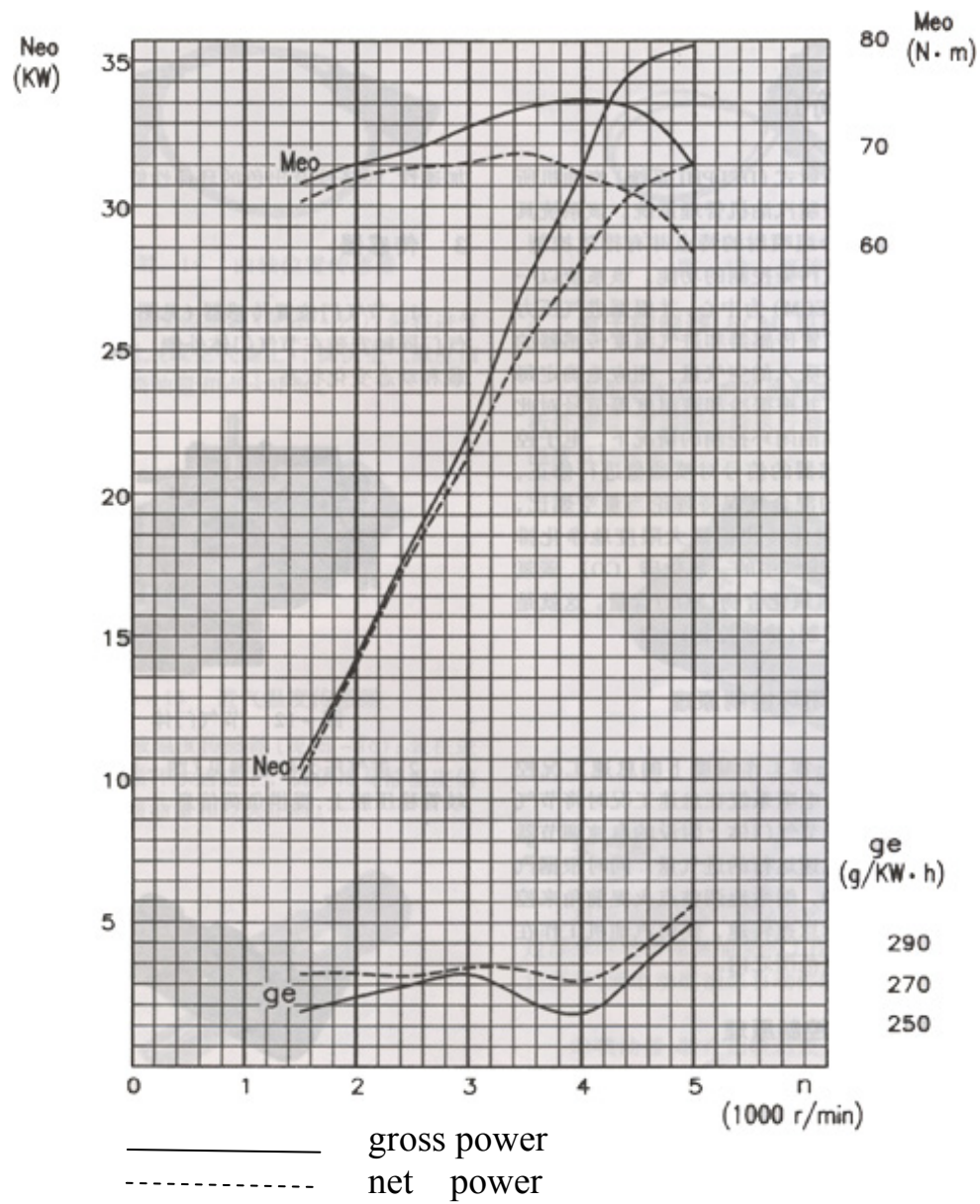


Fig.10 Full load performance curve of the DA465Q gasoline engine.

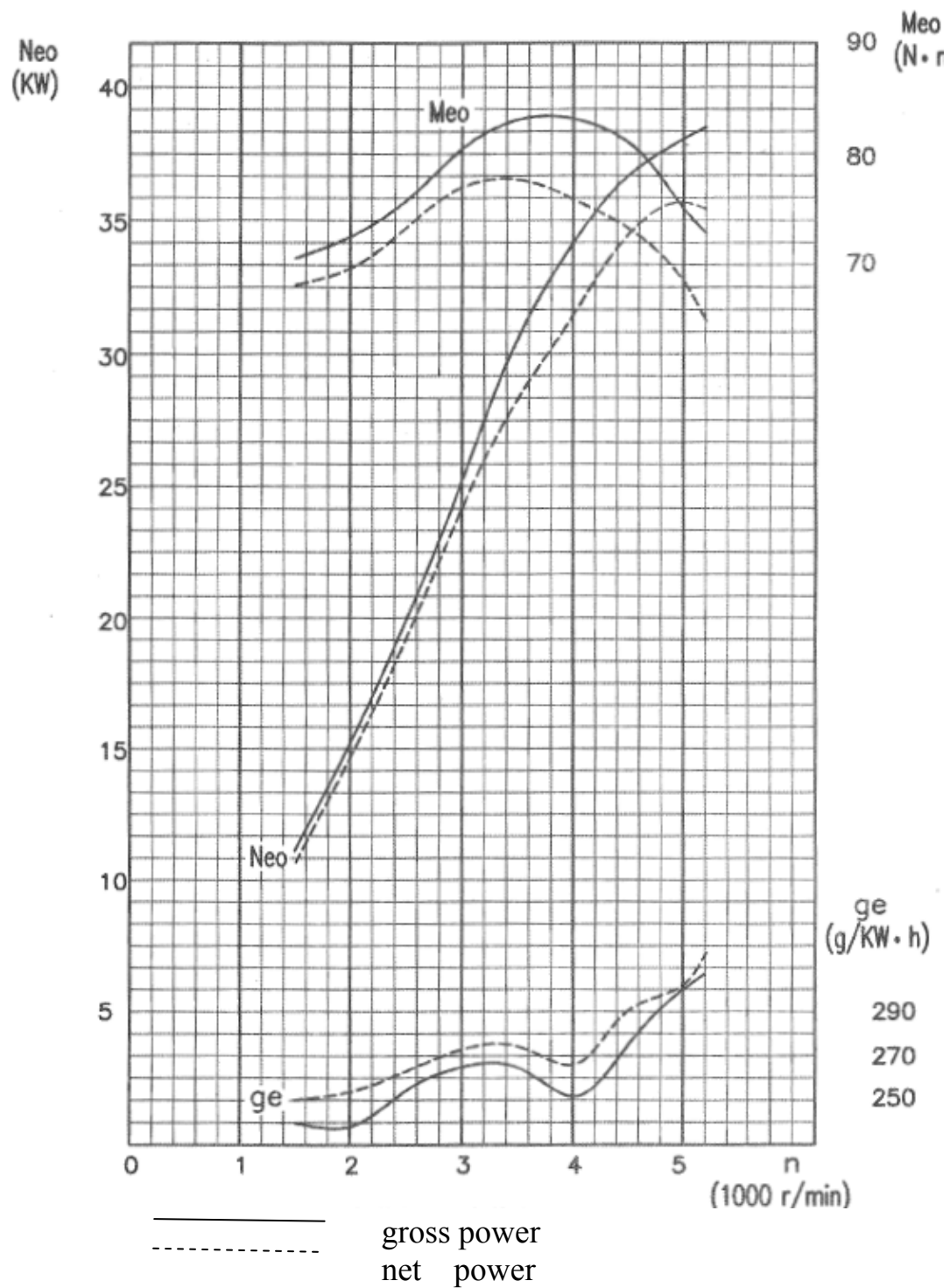


Fig.11 Full load performance curve of the DA465Q-1A gasoline engine.

Chapter 2 Operation of the petrol engine

Section 1 Brief introduction

The EMS of the electric fuel injection engine (DELPHI) adopts closed loop control. The system has the feature of grouping fire, sequential injection and has the function of emission control, idle control and evaporation emission control. The core of the system is an Electronic Control Module (ECM), and calculates the amount of air aspirated in each cycle according to the signal from inlet manifold air pressure sensor, speed sensor and inlet air temperature sensor, and determined the amount of fuel to be injected in each cycle, and corrects the fuel injection according to the signals from coolant temperature sensor and other sensors. Under the case of closed loop fuel control, ECM corrects the fuel injection according to the signals from oxygen sensor, to keep a theory A/F ratio. And it can make the three-way catalyst purify the emission maximumly, reduce the CO, HC, NO_x in the emission. This is equal air-fuel ratio closed loop control (emission control)

1. Principle of closed loop control to idle speed

The idle speed of the engine under normal temperature is closed loop controlled. EMS closes the throttle completely when under idle speed, and controls the amount of the intake air with idle controller on the throttle body.

And according to the speed of the engine adjusts the spark advance angle to control the actual idle speed and let the engine working at stated idle speed area.

2. Principle of electronic control to ignition timing

ECU determines a preset value of ignition advance angle according to load and speed, and corrects this value based on coolant temperature, acceleration etc, and then fixes a reasonable ignition advance angle. Thus ignition timing is determined.

Because of the EMS, the vehicle equipped with LIUJI electric fuel injection engine has well start performance, drivability, acceleration performance, economy performance and excellent environmental protection.

3. Sensors

1) Throttle valve position sensor (Fig.-12A): mounted outside the throttle body with throttle valve on same axle to offer load acceleration and deceleration information..



Fig-12 Throttle valve position sensor

2) Inlet manifold air pressure(MAP)

sensor (Fig.-13): mounted on inlet manifold stabilizer chamber or the fourth inlet manifold to provide engine load information.



Fig.-13 MAP sensor

- 3) Crankshaft position sensor(Fig.14): mounted at gearbox, provide speed and crankshaft phasic signal, the later will provide reference point for injection timing and ignition timing.



Fig.-14 Crankshaft position sensor

- 4) Inlet air temperature sensor (Fig.-14): integrated into inlet air manifold pressure sensor to offer air temperature for correcting fuel injection amount and ignition timing
- 5) Coolant temperature sensor (Fig.15): mounted at water outlet of inlet air manifold to offer coolant

temperature data for correcting fuel injection amount and ignition timing.



Fig.-15 Coolant temperature sensor

- 6) Oxygen sensor: mounted between engine and Three-way catalyst (Fig. 16) to offer exhaust gas concentration data for correcting fuel injection amount and closed loop control of A/F ratio.



Fig.-16 Oxygen sensor

4. Electronic control module (ECM Fig.-17) It was equipped on the vehicle body. After analysis and treatment to the signal input from sensors, ECM gives instruction to actuator.

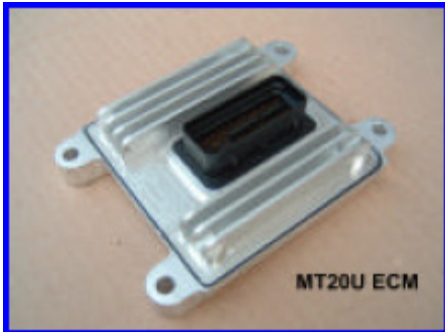


Fig. 17 Electronic control Module

5. Actuator

- 1) Electric fuel pump: mounted inside fuel tank, controlled by relay through ECM. In case of engine shutdown, the electric fuel pump automatically stops.
- 2) Fuel injector: mounted on fuel rail assembly, to inject fuel towards air port under control of ECU.
- 3) Ignition coil (Fig.18): The ECM of the engine adopt advanced no distributor direct ignition technology. The mount support of the ignition coil must be reliably grounded.



Fig. 18 Ignition coil

- 4) Idle speed regulator: mounted on the throttle body, its movement is controlled by ECM to change the cross-section area of bypass passage, thus changing the bypassing amount of air at idle speed for control of idle speed.
- 5) Purge solenoid (Fig. 19): it mounted under the inlet air manifold. Its duty-cycle is controlled by ECM, thus the cleaning air flow from

carbon canister to inlet air manifold.



Fig.19 Purge solenoid

Section 2 Notice on operation of the engine

1 Operation and maintenance manual

Please read this manual carefully and operate and maintain your engine in accordance with the instructions recommended therein.

2 Coolant

Check the coolant of engine and if necessary, replenish the coolant in accordance with the method described in section 2 of Chapter3.



During operation of the engine, there must be sufficient quantity of coolant to ensure the normal operation of engine, otherwise, "boiling" phenomenon will occur, and if the engine functions in overheating condition, its service life will be adversely affected, and moreover serious problems

could occur such as scuffing of cylinder bore.

3 Oil

Check the oil level, and replenish oil in time if necessary according to the method in section 1 of Chapter 3.

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Insufficient oil will result in excessively low oil pressure and improper lubrication, worsening of the engine wear and poor cooling, thus bringing out failure and affecting adversely service life of engine.

4 Fuel

Use of 87 Octane or above quality lead-free gasoline for motor is mandatory. Use of lower RON or poor quality gasoline (containing excessive lead, phosphor and sulfur etc) will damage the catalyst and oxygen sensor.

Our company will not take any responsibility for any damage to catalyst converter and oxygen due to use of improper fuel.

★★

The vehicle shall be filled with acceptable quality lead-free gasoline, otherwise EMS, Three-way Catalyst and oxygen sensor will be fatally damaged, and the performance of environment protection reduced.

5 Start up of gasoline engine

Since engine is equipped with electronic controlled fuel injection system, this system will automatically provide gas mixture at suitable ratio under any operating condition. Therefore before and as starting the engine the accelerator pedal shall not be used when the engine is in any condition.

When the engine cannot be started up after several trials, the spark plug is probably short circuit resulting from more fuel in cylinder. At this time the accelerator pedal shall be stepped down to the end, then starting the engine again, after 5~6 seconds, high speed gas flow will blow the overflowed fuel off. Then the pedal shall be released and the engine can be started up again.



Starter shall not operate for over 5 seconds each time. When the engine can not be started, it shall be started 10 seconds later, otherwise the starter may be damaged. If the engine can not be started after several attempts, please check the fuel injection system and electrical system, or come to motor plant and our company's service station for repair.

6 Idle speed

After start up of the engine, let it run for several minutes at idle speed for warm-up.

Normally the idle speed (water temperature over 60°C) is 850 ± 50 r/min or 850 ± 50 r/min. At cold state, the engine controlled by ECM runs at 1000 r/min for warm-up. With the water temperature increasing, this idle speed of engine will be gradually recovered to normal idle speed.

If the air conditioner is turned on while the engine operates at idle speed, the ECU will increase the idle speed up to 1100 r/min or so.

7 Running

The coolant temperature shall be kept between in 80 °C ~ 90 °C normal running of the vehicle. At intermediate speed, attention shall be given that the oil pressure not be lower than 0.294Mpa (3kg/cm²).

Due to use of EMS, the car has the

function of fuel cut-off in deceleration, which can realize the purpose for satisfactory fuel saving. While the engine keeps operating at idle speed when the car slides at neutral speed, it still consumes fuel..

8 Engine shutdown

During operation of the engine, especially under high speed and high load condition, the engine shall not be suddenly shut down, and shall be shut down after 3~5 minutes of running at lower speed.

The car shall not stop near flammable material, because the TWC with high temperature will probably cause fire.

9 In raining condition or across water area

When running in raining on water road or across water area in normal times, the tightness of air cleaner must be perfect to avoid infiltration of water into the engine cylinder thus to damage connecting rods etc.



Water is an incompressible fluid. With water entered the cylinder, it produces several decades of pressure rise on the connecting rods, causing the rods to be bended or broken.

10 Warming up of the gasoline

engine in winter

In winter the temperature is relatively low, the oil viscosity is increased, and the lubrication is not as efficient as in summer. So the car shall not immediately run after engine start up, and moreover the engine shall not operate under high speed and high load condition. The car shall run only when the engine is warmed up for about 10 minutes to let the oil and coolant temperature increase and let the engine lubricate sufficiently.

★★

In winter, if the engine operates when the lubrication is insufficient, this will result in excessive wear or even blocking of valve train components such as camshaft.

11 Gasoline piping

★★★

Due to high inlet fuel pressure 0.3Mpa (3 bar), the fuel inlet pipe must be explosion proof rubber pipe, the pipe must be fixed by fastener, and fuel leakage at pipe connection shall be checked frequently. As checking the fuel pipes, it is strictly prohibited to check the electrical fuel pump by starting the engine after the inlet and outlet fuel pipes of the fuel rail

are removed. Otherwise fire may take place due to gasoline flowing out.

12 Fuel injector

According to the operation of the imported car equipped with fuel injection system in China and the actual condition of the fuel in our country, when the car is to be parked for long time, it is required that the engine shall run for 3 to 5 minutes every 2-3 months to avoid that the fuel injector is blocked due to gumming in petrol, ensuring the car in good condition.

13 Three Way Catalyst(TWC)

The TWC is mounted on exhaust system of EMS for post-treatment of exhaust. It can effectively reduce the harmful gas in the exhaust. A set of quality EMS shall not only ensure the normal operation of the engine, but also ensure the efficient conversion operation and provide the overheat protection function to prolong its service life of TWC.

The TWC is subject to overheat during operation of gasoline engine, and is easily damaged due to overheat. In order to protect the TWC, the driver shall pay attention to the following conditions during driving:

- 1) only quality lead-free gasoline RON90 or above can be used.
- 2) Do not start the engine by forced pulling forward or dragging the car. When the battery is low, please use auxiliary battery to start the engine.

3) Don't make ignition diagnosis by removing the spark plug wire while the engine is running.

4) Don't force the engine to operate when the engine is flameout resulted from ignition system failure. Otherwise it will result in the damage to the TWC.

5) Don't force the engine to start or operate when the engine does not operate very stably at idle speed or the engine can not start through long time.

6) If the car performance becomes worse to great extent or the engine does not operate normally such as malfunction of fuel supply or ignition system, you shall stop your car immediately and try to eliminate the fault. If it is not allowed to stop immediately, you shall reduce the speed and drive for a short distance to find a service station.

14 Throttle body

The adjustment screw on throttle valve body shall not be adjusted by the customer, it has been set for air leakage in the factory before it is delivered. The idle speed and emission may be adversely affected if you adjust the screw.

15 Electric fuel pump

When the car is filled with fuel at the first time or the fuel is used up, the filling amount (not less than 5 liters is recommended) shall ensure the fuel level of fuel tank exceed the fuel inlet height of fuel storage barrel, making the suction port of the fuel pump in the fuel storage barrel is completely immersed in the fuel and the car start up successfully. Due to special structure design of the

fuel storage barrel, when the fuel level in fuel tank is low the fuel level in storage barrel can be kept higher than that of the tank, thus it is ensured that the engine will not be flameout during downhill or uphill driving resulting from no fuel from fuel pump.

16 Fault indication

Indicators (optional) are mounted on the instrument panel, whenever the system has fault, the indicator will light, at this time please come to the professional personnel for fault diagnosis by means of fault diagnosis instrument.



When some of the parts on EMS are broken, you can continue to drive your car but the driving performance will worsen to remind you that you shall send your car for service.

Section 3 Run-in of the new gasoline engine

The service life of a gasoline engine is largely related to the initial operation condition. Run-in of a new engine shall be carried out for about 2500 km on the car or for 30 hours on the test bench according to the run-in regulations.

The procedures for run-in of engine on the car are as follows:

1 Check

Check to see if the oil, coolant,

fuel, and electrolyte in battery etc are sufficient, replenish or correct if quantity is not sufficient or leakage must be replenished.

2 Road surface

The car shall run on cement or asphalted road, and shall try not to drive on other roads, especially on sandy soil road.

3 Specifications for run-in

The run-in of the gasoline engine on the car must be performed in accordance with the specifications listed in table 2 below. The speeds at different gears in the table must not be exceeded. If there is any deviation between run-in specifications of the car and the run-in specifications herein, the latter shall

prevail.

4 Load

During run-in operation, for the first 1000 km, the load shall not exceed 50% of the rated load, and for the remaining 1500km, the load shall not exceed 75% of the rated load.

5 Maintenance

After run-in for 2500km, the engine shall be maintained in compliance with the requirements listed in Table 3.

Table 2 specifications for run-in of a new engine on car

speed position of gearbox	Car speed
Gear 1	10km / h
Gear 2	20km / h
Gear 3	35km / h
Gear 4	55km / h
Gear 5	65km / h

Table 3 maintenance to be performed to a new engine after run-in

Items	Operations
1 Water pump rubber belt	Check for wear and adjust the tension
2 Timing belt	Check and adjust the tension
3 Valve gap	Check and adjust if necessary
4 Screws for cylinder head and nuts for inlet and exhaust manifold.	Tighten to required torque
5 Oil filter	Replace
3 Oil	Replace
7 Gear oil of gearbox	Replace
8 Spark plug gap	Check and adjust to rated value

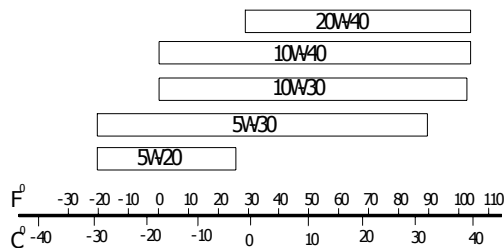
Chapter 3 Maintenance of the gasoline engine

Section 1 Maintenance of the lubrication system

your car and every 300 to 500 km of driving.

1 Oil for gasoline engine

Select applicable API oil SE, SD or SF based on the operation temperature of the oil and according to the temperature in the area where the engine is used.



Replace oil after 2500km run-in of a new engine and every 5000km normal running of an engine.

2 Measurement of oil level of the engine

The oil level in oil pan is measured by oil stick. To measure the oil level, withdraw the oil stick (Fig20) about 5 minutes after the engine stops, wipe off the oil with clean cloth and insert it into oil pan for measuring. The oil level shall be between the upper and lower marks on the stick (see Fig.21). if the oil level is close to or lower than the lower mark, fill the oil up to upper mark. Check the oil level before your setting off with



Fig.20 the oil stick

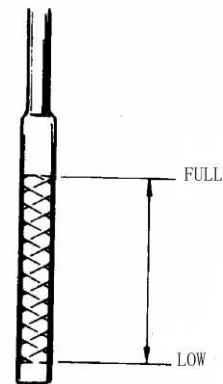


Fig. 21 oil level

3 Renewing oil

Driving on asphalted road, oil shall be renewed every 5000km, while driving on sandy soil road, check shall be often performed to oil and renew oil in time depending on the oil quality, but anyhow oil shall be renewed every 5000km. .



To renew oil, preheat the engine for about 10 minutes, then stop the engine, open filler cap (see Fig. 22), and unscrew the drain plug on oil pan of the engine (see Fig. 23) while oil is still warm, and drain off the oil, renew and tighten the drain plug. Fill about 3 liter of new oil before putting the filler cap in place.

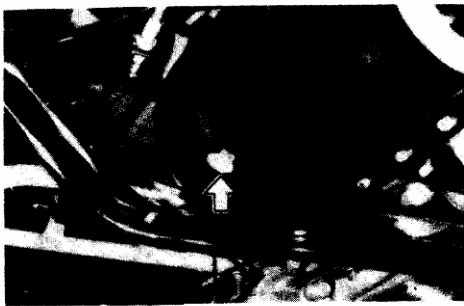


Fig. 23 oil drain plug

Five minutes after start up of the engine, check oil leakage, then stop the engine and wait for another 5 minutes to check the oil level. Replenish oil to upper mark of the oil stick if it is not enough.



Caution shall be exercised so as not to be burnt by hot oil when unscrewing the oil drain plug.

4 Oil for gearbox

85W/90 GL-4 gear oil or GL-5 gear oil (GB13895-92) Or No.18 hypoid gear oil



Use of suitable oil for engine and gearbox is an essential factor to ensure their normal operation and service life. Special attention shall be given, when making choice of oil, not to mix up oils of different origins, brands and standards, in order to prevent from chemical reaction, thus adversely affecting the normal operation of engine.

5 Renewing oil in gearbox

Gear oil in gearbox shall be renewed every 40000 km (except for run-in stage).

To change gear oil for gearbox, preheat the engine for about 10 minutes, then stop the engine, then unscrew the filler plug on middle casing of gearbox (see Fig. 24) and the drain plug on bottom of middle casing of gearbox (see Fig. 25), drain off the oil in gearbox and renew the drain plug. Fill the gear oil through filler port up to oil overflow from the filler port.



Filling oil through the mounting hole for reversing light switch is strictly forbidden.

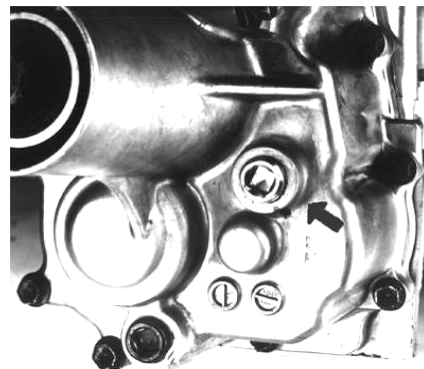


Fig. 24 Filler plug of gearbox

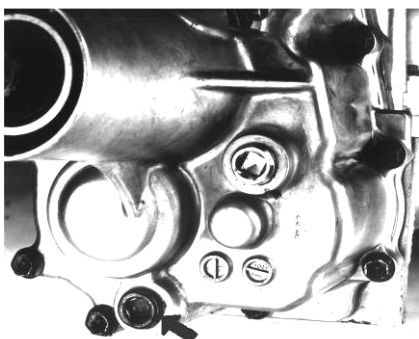


Fig.25 Drain plug of gearbox

6 Washing of lubrication system

If a large quantity of impurities is accumulated in oil pan, washing with light spindle oil shall be carried out to the lubrication system.

★★★

Washing with gasoline or kerosene is absolutely prohibited.

To wash the interior of the engine, fill in 3 liter light spindle oil through filler port, start the engine with starter to idle speed for 2 or 3 times, lasting 1 minute each time, then rapidly drain off the light spindle oil for washing and fill in lubrication oil according specifications. If washing is performance whenever the oil is renewed, the engine service life will be greatly increased.

Each time after renewing oil, run the engine for 3-5 minutes without load to ensure the lubrication system and all lubricating points are supplied with enough oil.

7 Replacement of oil filter

Replace the oil filter every 10,000 km running after running in for 2500 km. The tightening torque when mounting the filler is 9.81-14.7N.m. (1.0 ~ 1.5kg.n.m).

8 Check of oil pressure indication system

In normal condition, when power supply switch is turned to “ON” position, the oil pressure indicator lamp lights up, that indicates there is no oil pressure. Then continue to turn the switch to “Start” position, the engine is started and enters idle speed condition, at this time, oil pressure indicator lamp goes out automatically, that indicates oil pressure is normal. If the oil pressure indicator lamp does not go out, that means oil pressure in the engine lubrication system is abnormal, the check is needed to see if there is sufficient oil in the engine.

When the oil pressure indicator lamp does not light up after turning the power switch to “I” position, while there is still electric current in circuit, and there is no current at idle speed, that indicates oil pressure sensor is in good condition. At this time, check should be performed to indicator lamp and to relevant circuits for defect.

Section 2 Maintenance of the cooling system

The cooling system is one of those conditions indispensable for normal

operation of the engine, therefore sufficient quantity of coolant must be assured inside the engine, and checks must be carried out before driving and replenish coolant if necessary.

1 Coolant

Distilled water or suitably treated soft water as well as anti-freezing fluid can be used as coolant for the electric fuel injection engine. The ice point of the anti-freezing fluid shall be 5°C lower than the minimum temperature in the region where the engine is used.

When water is used as coolant in winter, garage with heating system shall be available or water inside the radiator and engine shall be drained out in time after parking to prevent from damage to radiator or engine resulting from freezing. For the engine of which cylinder block has no water drain plug, water cannot be used as coolant in winter.



As water is frozen, its volume will be expanded, this will damage the sealed radiator, water pump, cylinder head and cylinder block.

2 Filling the coolant

Proceed to fill the coolant as follows: :

(1) Unscrew the radiator cover and fill up the radiator with coolant (Fig.26), and the coolant tank shall be filled up to "FULL" mark (Fig.27). Caution shall be exercised so as not to surpass the "FULL" mark.

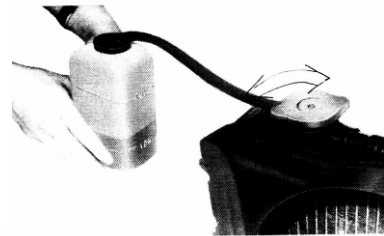


Fig. 26 Radiator cover and coolant tank



Fig.27 water level mark of water tank

(2) Put the radiator cover in place and tighten it.

(3) Start the engine, run it at idle speed for 2-3 minutes, then unscrew the radiator cover. When some air in water piping goes out, the coolant level will decrease; at this time replenish coolant to the level mark "FULL".

(4) Replace the radiator cover and tighten it, then the engine can operate normally.



In hot condition of the engine, it is not allowed to open the radiator cover to avoid personnel being burned.

3 Coolant replenishing

After long time of operation, when coolant level in the tank is below the level mark "LOW" (see Fig. 30), coolant replenishing shall be performed in accordance with the procedures for coolant filling.

If in short time the coolant is reduced considerably, there is possibly leakage in cooling system. Careful check shall be made.

4 Coolant renewing

After long term of operation, because of deterioration of coolant or repair etc., renewing coolant becomes necessary. Proceed as follows:

1) Unscrew the radiator cover, open the drain valve at the bottom of the radiator (Fig.28), to drain out the coolant.

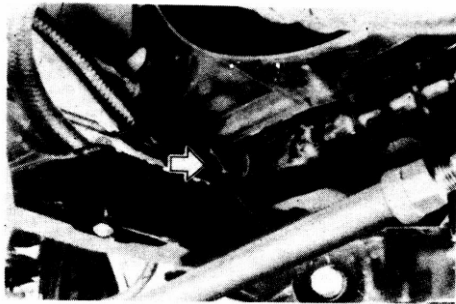


Fig. 28 Drain valve of radiator

2) Dismount the coolant tank, empty it of coolant.

3) Unscrew the water jacket drain plug on the lower part of the fourth cylinder to drain out coolant.

4) Reassemble the water tank, radiator drain valve, water drain plug on cylinder block, and fill in coolant according to coolant filling procedures.

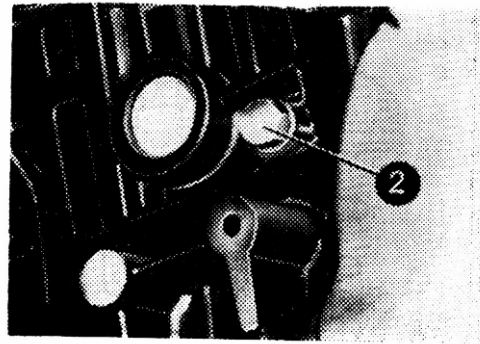


Fig.29 Water drain plug for cylinder body



When renewing coolant, the car shall park on level ground.

5 Not placing the thermostat is prohibited.



If the thermostat is not replaced after being dismantled, the warming up time of engine after startup will be prolonged, and if the engine operates under low temperature for long time, the mechanical parts' wear will be worsened and service life of engine be adversely affected.

Section 3 Maintenance of the fan rubber belt

The rubber belt of the fan is used for driving the electric motor, water pump and fan. Check and maintenance should be often carried out to fan rubber

belt.



IF the fan belt is not properly tensioned or is worn out, it will cause engine overheating and electrical energy generation reduced.

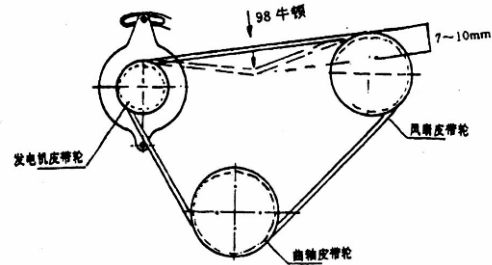


Fig.31 check of tension

1 Adjustment

Stop the engine, loosen the two fixation screws in the lower part and the set screws in the upper part of the electric generator (see fig30), pull outward the electric generator so that the fan belt reaches the tension required in item 2 of the section.

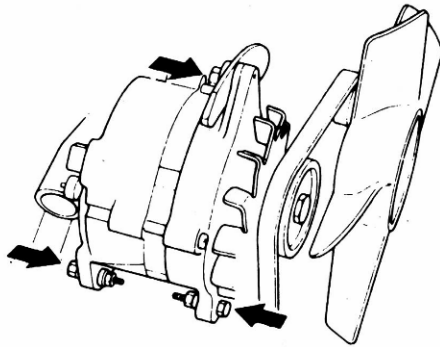


Fig .30 fixation screws for electric generator

2 Measurement of tension

Apply a force of about 98N(10kg) on the belt in the middle position between the electric generator and the fan, as shown in fig.31. For new belt, deviation should be about 7-10mm, while for used belt, it is about 10-15mm.

3 Appearance

The fan belt should have a perfect appearance. Replace it if there are any defects affecting its normal use.

Section 4 Maintenance of the air cleaner

The cleaner is used for filtering the air entering the cylinder. A poor cleaning of air will speed up wearing of the engine and shorten the service life. And air cleaner plugging affects adversely air entering the engine, causing insufficient air flowing into the engine and reduces horsepower.

The filtering element of the air cleaner should be often dismantled or cleaned. On asphalted road, every 10000km of running, the element should be cleaned, while on soil road, every 2500km of running, the element should be cleaned. Cleaning is to be conducted according to following procedures.

1 Air cleaner dismantling

Open the clamp on the air cleaner body, remove the cleaner cap to

withdraw filtering element (see fig. 32).

★★

The gasoline engine is not allowed to operate without air cleaner. Air cleaner going along with the engine should be used. Check the seal strip at both ends of the cleaner to assure perfect tightness while mounting. A poor tightness would make the cleaner unable to play its role and speeds up wearing of the engine.

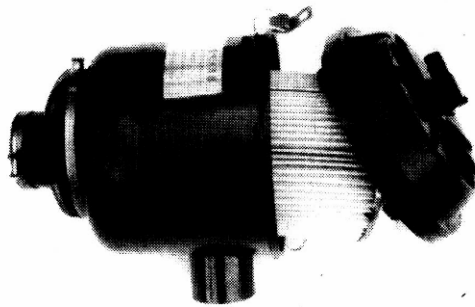


Fig. 32 Air cleaner

2 Cleaning

Blow off dust on filter element with compressed air (see fig. 33). Paper element can be washed with gasoline, and then blown dry with compressed air. Damaged element should be replaced in time.

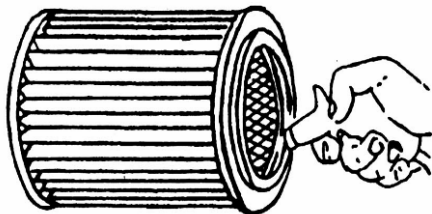


Fig. 33 cleaning of the air cleaner

3 Remounting

Remount the filter element and the cleaner cap in reverse order.

Section 5 Maintenance of the Gasoline Filter and Fuel Pipelines

The high fuel supply pressure (up to 0.3MPa) of EFI system and small diameter of injector orifice require that the fuel filter shall have sufficient cleaning performance, otherwise the block of injector and even the malfunction of engine will be resulted. Normally the gasoline filter shall be replaced after every 10000 km. In case the fuel is very dirty, the filter shall be replaced in time to prevent the injector from blocking.

★★

Gasoline filter for conventional carburetor engine shall not be used for EFI gasoline engine.

Section 6 Maintenance of the Valve Train and Timing Belt

Frequently check and maintain the valve train and timing belt. In case of timing belt broken or slipped, collision of valve with piston will occur, resulting in the damage of components including valve, piston, rocker arm, and camshaft, etc. Therefore except during the

breaking in period, check it after every 20000km, and properly adjust or replace it if necessary.

★★★

It is strongly recommended that this check or maintenance work be performed by the car manufacturer, our service station, or our authorized service center whether you are the expert or not.

1 Check of Timing Gear and Adjustment Valve Clearance

Open the timing belt cover, check the assembling mark position of the driving and driven timing gears for correctness, if the mark positions are not correct or timing is doubtful, following check is necessary.

Remove the spark plug, referring to flywheel graduations through the sight hole on the bell housing, rotate the flywheel in the working direction, so that the key way on the front end of the crankshaft is in line with the arrow on inner cover of the timing belt, then check to see if the piston of the first cylinder of the engine (at the radiator side) is at top dead point of its compression stroke, that is, there is clearance between the inlet valve and the rocker arm, and between the exhaust valve and the rocker arm. If not, rotate the crankshaft for further 360°, the circular pit mark on the driven timing gear edge (opposite to the keyway) should be aligned with the arrow on the inner cover of the timing belt. If big deviation is found, adjustment should be done. Also check the timing belt tension

following the requirements of fig. 37.

Rotate the crankshaft for 360° so that the first cylinder is at top dead point of its exhaust stroke, and the fourth cylinder is at top dead point of compression stroke, so one of the two marks on the driven timing gear edge, which is opposite to the key way, should be in line with the triangular mark (∇) on the timing belt cover (see fig. 34).

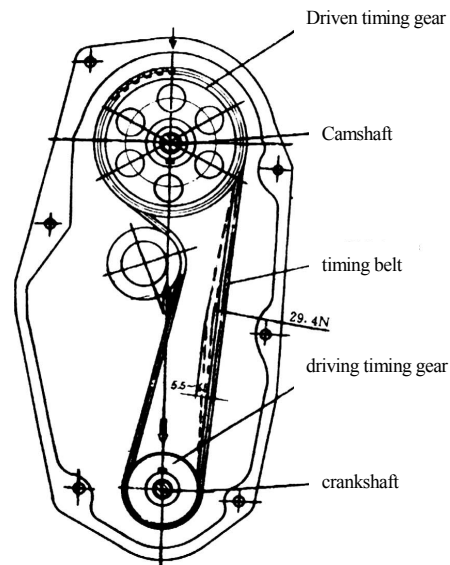


Fig. 34. Maintenance of valve mechanism

2 Timing belt

Check the timing belt in accordance with the requirements of table 4, and if there are cases similar to those listed in the table, locate the causes and eliminate them in time. For

serious cases, timing belt should be changed to a new one. In normal conditions, timing belt should be replaced every 10000 km of driving.

Table4. Check of timing

No.	Description of failures
1	Hardening of the belt surface The back of the belt is bright, has no longer resilience and is hardened. No trace left when pressing the belt with the nail.
2	The belt back cracked.
3	The belt cracked or the fiber cloth stripped
4	Teeth wore (at first stage) The fiber cloth on the edge of load wore lateral face also wore.
5	Teeth wore (final stage) The fiber cloth on the edge of load wore out The rubber exposed (tooth thickness reduced)
6	Teeth roots cracked
7	Teeth detached
8	Lateral face of the belt wore
9	Lateral face of the belt cracked

Section 7 Maintenance of the Ignition System

Ignition angle was controlled by ECU, need not to adjust.

Section 8 Maintenance of Spark Plug

Replace the spark plug after every 10000 km. Replace it any time if the damage is found. Pay attention to make sure the type of spark plug F6TC(4C7T), thread M14×1.25.

The contact surface between insulator of spark center electrode and external electrode shall be clean, free of carbon deposit. Remove with fine sand paper if there is carbon deposit.

Spark plug gap shall be 1.0~1.2mm (as shown in Fig. 35), evenly and equally distributed through the surface of center electrode.

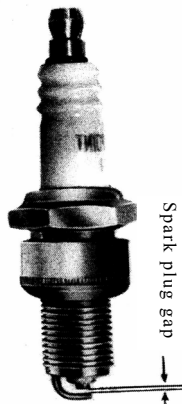


Fig-35 Spark Plug Gap

Section 9 Maintenance of Positive Crankcase Ventilation valve (PCV valve)

PCV valve is composed of valve body, valve gate, valve cap and spring, and is not dismountable. Its main purpose is to direct the air in the crankcase through the PCV valve into the inlet manifold, and a small amount of air goes into inlet manifold through PCV valve directly from the air cleaner, so that some problems such as icing in the throttle body, insufficient combustion and bad emission are avoided. Dismount it every 5000 km of driving, clean it with gasoline and blow it dry, and then push the flap with a steel wire to make sure its free movement. If the flap is blocked, the valve should be replaced.

Chapter 4. Regular check of the gasoline engine

Section 1 The maintenance period and items

The service periodicity is calculated on basis of odometer or months. (whichever comes first)		km×1000	2.5	10	20	30	40	50	60	70	80
		month	2	6	12	18	24	30	36	42	48
1*	fan belt (check for elasticity and wearing)	A	—	I	—	R	—	I	—	R	
2*	timing belt (check for damage and wearing)	I	—	I	—	I	—	I	—	I	
3*	inlet and outlet valve gap	A	—	A	—	A	—	A	—	A	
4*	tightening torque of the nuts and screws for fixing inlet and exhaust manifolds and of the bolts for the cylinder heads	T	—	T	—	T	—	T	—	T	
5	oil filter	R	R	R	R	R	R	R	R	R	R
6	oil	After running in for 2500km, be renewed every 5000km of driving									
7	fuel rubber pipe and connections (check for aging of rubber pipe and cracking or damage of connections)	I	I	I	I	I	I	I	I	I	I
8	rubber pipe and connections for engine cooling system (check for water leakage and damage)	—	—	I	—	—	I	—	—	I	
9*	Spark plug wire (check for degradation and damage)	—	—	I	—	—	I	—	—	I	
10*	spark plug										
11	air cleaner	On asphalted road, to be cleaned every 10000km of running. On soil road, to be cleaned every 2500km of running.									
12	throttle gate control wire	—	I L	I L	I L	I L	I L	I L	I L	I L	I L
13	gasoline filter	—	R	R	R	R	R	R	R	R	R
14	PCV valve	—	—	I	—	I	—	I	—	I	

15*	clutch clearance	I	I	I	I	I	I	I	I	I
16	gear oil for gearbox (check for oil leakage in horizontal condition)	R	I	I	I	R	I	I	I	R

Note: Meaning of symbols used in the table:

A: check or adjust

L: lubricate

R: replace

I: check, and adjust or replace if necessary

T: check with special torque wrench



Whether you are a expert or not, we recommend the items marked with an asterisk “*” to be entrusted to technical service stations or special maintenance centers of car manufacturer or our company.

Section 2 Tightening torque of main bolts for engine

No.	Description	tightening torque	
		N·m	kgf·m
1	cylinder head screws	53.9~58.8	5.5~6
2	nuts for air inlet and outlet manifold	17.7~22.6	1.8~2.3
3	spark plug	19.6~29.4	2~3
4	screws for driven timing gear	49.0~58.8	5~6
5	nuts for adjusting valve gap	14.7~19.6	1.5~2
6	screws for driving timing gear	49.0~58.8	5~6
7	nuts for connecting rod bearing cover	27.5~31.4	2.8~3.2
8	screws for crankshaft bearing cover	42.2~47.1	4.3~4.8
9	flywheel screws	39.2~44.1	4.0~4.5
10	screws for oil pan	3.92~4.90	0.4~0.5
11	oil drain plug	19.6~24.6	2.0~2.5
12	screws for valve cover	3.92~4.90	0.4~0.5
13	screws for cover of timing belt	2.94~3.92	0.3~0.4
14	fixing screws for oil pump	7.85~9.81	0.8~1.0

15	oil pressure sensor	11.8~14.7	1.2~1.5
16	nipple for oil filter	19.6~24.5	2.0~2.5
17	set screws for rear suspension bracket	17.7~22.6	1.8~2.3
18	set screws for engine bracket (left and right)	17.7~22.6	1.8~2.3
19	mounting bolts for damping cushion	24.5~29.4	2.5~3.0
20	screws and threaded bush for tensioning wheel support	14.7~22.6	1.5~2.3
21	Coolant temperature sensor	15~20	1.5~2.0
22	Oxygen sensor	38~46	3.9~4.7
23	set screws for throttle body	8~10	0.8~1.1
24	set screws for crankshaft position sensor	8~10	0.8~1.1
25	set screws for inlet manifold air pressure sensor	8~10	0.8~1.1
26	spring seat for safety valve of oil pump	14.7~19.6	1.5~2.0

Section 3 Tightening torque of the main bolts for gearbox

No.	Description	tightening torque	
		N.m	kgf.m
1	connecting screws for gearbox housing	14.7~19.6	1.5~2.0
2	oil filling and drain plugs	29.4~49.0	3.0~5.0
3	connecting screws for extension housing	14.7~19.6	1.5~2.0
4	screws for gear-shift shaft housing (8mm)	8.83~11.8	0.9~1.2
5	screws for gear-shift shaft housing (6mm)	5.88~9.81	0.6~1.0
6	locking screws for gear-shifter shaft	14.7~19.6	1.5~2.0
7	connecting bolts for gearbox and	19.6~24.5	2.0~2.5

	cylinder block		
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Section 4 Tightening torque of the main bolts for clutch

No.	Description	tightening torque	
		N.m	kgf.m
1	screws for clutch housing	17.7~27.5	1.8~2.8

Chapter 5 Malfunction and troubleshooting

Section 1 Difficult to start

Symptoms and causes		Remedy
a 、 Starter does not rotate.	1 loose connection at battery pole or low battery.	Retighten or recharge
	2 with disconnection on circuit	Check and correct
	3 starter damage	Repair or replace
b 、 Ignition system fault.	1 improper grounding	Repair
	2 ignition coil damaged	Replace
	3 improper spark plug gap or presence of carbon deposit	Readjust, clean or replace
	4 cut-off or short circuit with harness	Repair or replace
	5 disconnection of crankshaft position sensor	Check and repair
	6 damage of crankshaft position sensor	Replace
	7 main relay or oil pump relay damaged	Replace
	8 Electronically Controlled Module (ECM) damaged	Replace
c、 trouble in fuel supply system	1 fuel pressure from electrical pump not sufficient	Repair or replace
	2 fuel injector damaged or blocked	Replace or clean
	3 fuel pipe or filter blocked	Readjust or replace
	4 vacuum tube of oil pressure regulator fallen off or damaged	Mount or replace
	5 crankshaft position sensor damage or wire broken	Replace or Readjust

	6 main relay or oil pump relay damaged	Replace
	7 cut-off or short circuit with harness	Check and repair
	8 Electronically Controlled Module (ECM) damaged	Repair or replace
d compression force of cylinder reduced	1 cylinder gasket cracked	Replace
	2 valve gap improperly adjusted or damaged	Readjust, repair or replace
	3 piston, piston ring and cylinder bore worn	Repair or replace

Section 2 Idle speed too high

1 damage of throttle position sensor	Self-learning after power off.
2 throttle gate unable to completely return home position	Check and adjust
3 leakage of intake system	Check and repair
4 idle speed regulator (step motor) damaged	Replace

Section 3 Power insufficient during running

1 improper adjustment of accelerator pedal and throttle body wire.	Adjust
2 reduction of cylinder compression force	1 check leakage of valve, sparkplug and cylinder gasket; 2 grind the cylinder bore
3 ignition timing not accurate	Adjust
4 fuel pressure regulator is damaged, so gasoline supply is insufficient	Adjust or replace
5 insufficient intake air	Check air intake system
6 exhaust system stocked	Check exhaust system and remove carbon deposit
7 improper gap or defective spark plug	Adjust, clean or replace
8 injector blocked or damaged	Clean or replace
9 fuel filter blocked	Replace
10 throttle position sensor damaged	Replace

11 electric fuel pump with insufficient pressure	Repair or replace
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Section 4 Knock inside the engine

1 bush, camshaft, cam and rocker arm worn	Replace
2 crankshaft, crank pin and piston pin seriously worn	Replace or repair
3 piston ring damaged	Replace
4 improper gap of valve	Adjust
5 excessive thrust clearance of camshaft and crankshaft	Adjust

Section 5 Engine overheating

1 improper ignition timing	adjust
2 improper spark plug gap or carbon deposit	adjust or clean
3 intake manifold loosened, exhaust manifold blocked	tighten or purge
4 fan belt insufficiently tensioned	adjust
5 coolant flow insufficient or water pipe blocked	replenish or purge
6 water pump clearance insufficient or defective	repair or adjust
7 lack of oil	replenish
8 oil passage blocked or oil pump defective	unblock or replace
9 cylinder gasket damaged	replace
10 clutch slippery	repair or replace
11 radiator blocked by scales	clean up or replace

Section 6 Excessive oil consumption

1 oil seal of the valve guide worn or defective	replace
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2 oil ring worn or damaged	replace
3 piston ring gap not staggered as required	adjust
4 defective cylinder gasket	replace
5 valves and guides worn	replace
6 engine overheating, internal pressure increasing, partial oil going out through the vent	check components and troubleshoot

Section 7 Difficulty in shifting gears

1 synchronized internal gear wore	replace
2 synchronized external gear wore	replace
3 positioning ball damaged	replace
4 shifter fork distorted or worn	repair or replace

Section 8 Noise inside the clutch

1 throw out bearing worn or damaged	replace
2 bearing of front output shaft worn	replace
3 clutch hub loosened	repair
4 clutch housing cracked	replace
5 cone springs loosened	repair or replace
6 clutch plate stained with oil	clean up or replace
7 clutch damping rubber or springs broken	replace

Section 9 The fault indicator on instrument panel keeps “on”

1 fault with EMS	Diagnosis with diagnosing instrument
2 fault with wire harness	Check (secure connection, cut off or short circuit)

Section 10 Emission not acceptable	
1 oxygen sensor and catalytic damaged due to the usage of petrol with lead.	Replace
2 oxygen sensor and catalytic damaged due to the fault of ignition system (miss fire and improper ignition timing)	Replace
3 leakage of exhaust system, and ECU received wrong oxygen sensor, thicker fuel injected.	Repair

Chapter 6. Preservation and unseal of the engine

Section 1 Preservation and storage of the engine

1. Drain off coolant from the radiator and the cylinder block.
2. Wipe the external surface of the engine with washing gasoline.
3. While the engine is still in hot condition and the pistons are between top and bottom dead points, unscrew the spark plugs, fill every cylinder with 10 ~ 15g of 217# anti-rust oil and rotate the engine 3 ~5 revolutions, then retighten the spark plugs with specified tightening torque and plug the exhaust pipe.
4. Wrap the connections of the throttle body, the water inlets and outlets of the engine, the bush of the tachometer or plug them well.
5. Put the engine into packing box.

Section 2 Unseal of the engine

1. Clean off the grease from external surface of the engine.
2. Unscrew spark plugs, run the engine without load, drain off as far as possible the anti-rust oil inside the cylinders (cleaning inside of the cylinder with small amount of gasoline can be effected if necessary).
3. Fill the engine with oil.

4. Fill the engine with coolant.
5. Unseal all plugged places.

USER'S COMMENTS

To improve ceaselessly the engine performances and quality and to better serve the vast users, please send us at any time in the midst of your pressing affairs, any problems found in operating your engine purchased from our company and your improving comments to following address and give detailed description of the problems found and your comments:

Sales department

User comments

No. of the engine		Date of manufacture	
unsealing date		Total operation time or mileage	
User name			
comments and suggestions (in detail):			